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ABSTRACT

Instructional technology can help teachers formalize alternative methods of assessment. It allows them to record and report on student performance more fully and more dynamically. This paper discusses tools and methodologies used by a group called Teachers Using Technology to Measure Mathematics Meaningfully as they expanded their repertoire of classroom assessment techniques to incorporate instruments such as computers, video cameras, and Sunburst's Learner Profile. These tools assist not just with the delivery of tasks but with the collection of data and observations about student response. The paper also chronicles the formation of Teachers Using Technology to Measure Mathematics Meaningfully, discusses their goals and research activities, and suggests some future implications for the use of technology in alternative assessment. (Contains 14 references.) (Author/BEW)

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Teachers, Technology & Testing: Exploring New Tools for Alternative Assessment

by Kathleen Kelly-Benjamin

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Teachers, Technology & Testing: Exploring New Tools for Alternative Assessment

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Abstract

Since January, 1994, 15 teachers from the Teachers Using Technology to Measure Mathematics Meaningfully (T^2M^3) Project have been developing assessment materials for elementary and middle school mathematics, that make use of technology for the delivery and collection of student achievement information. This paper discusses the tools and methodologies utilized by the T^2M^3 teachers as they expanded their repertoire of classroom assessment techniques to incorporate a range of technologies. The tools included computers and software, video cameras, the Newton, scanners, and the Learner Profile. Assessments methods included interviews, portfolios, and scoring rubrics. Discussion of the results of the T^2M^3 Project suggest ways that technology can allow teachers to embrace alternative assessments. Implications for expanding the use of technology beyond instruction to assessment offer new areas of research. This paper addresses the implications for the use of technology for alternative assessment.

Introduction

Teachers "test" their students using an assortment of teacher made paper and pencil exams that focus primarily on the content domain they teach. However, their assessments often go beyond these measures to include observations, interviews, continuous instructional monitoring, and performance samples of their students' work in a variety of situations. These data provide additional feedback about individual student's growth and change and the effectiveness of the teachers' instruction. The resulting evaluations are holistic appraisals depicting broad pictures of students as learners (Brophy & Good, 1986; Carpenter, 1989; Natriello, 1987; Reynolds, 1992). These new models of assessment allow for increased understanding of how learners construct new knowledge (Cobb, 1990Greeno, 1989). However, these new assessment techniques require new tools.

Instructional technology can help teachers formalize these alternative assessment. Educational technology holds promise for addressing some of the increased demands that meaningful and dynamic assessment place on teachers. For example, projects such as the Jasper Series (Vanderbilt University, 1990) highlight the possibilities of using technology in more supportive ways. These projects have helped move educational technology from being a tool for varying traditional instructional activities to creating powerful educational environments (Scott, Cole, & Engel, 1992). However, for the most part, even teachers who are using technology for instruction have not fully incorporated these tools into their assessment repertoire (Ginsberg, Sebastian, Underwood, Anderson, Kridel, & Stevenson, 1994).

Technological tools furnish the means for presenting a variety of assessment tasks and situations. Technology also allows us to record students' performance, tracking the actions they take while forming, testing, and verifying hypotheses. Lastly, technology allows for fuller reporting of information, for example, video vignettes of student performance. Affordable videotape and videodisk equipment, as well as microcomputers, calculators, and other interactive systems, can facilitate dynamic assessment (Kaput, 1992). Technology makes it feasible to capture and store students' actions and procedures and provide structured and more accurate records of prior actions. Yet, only 12% of video-based courses integrate any assessment tools as part of the courseware (Barrett, 1990).

Exactly how current and future technology can contribute to assessment is still mostly speculative. Potentially, educational technology promises the delivery of more realistic assessment situations and the tools for going beyond paper and

pencil records and informal observations to more fully record student achievement. However much of the previous research related to educational technology and assessment has focused on computer-based techniques for administering, scoring, reporting, and interpreting test items (Bunderson, Inouye, & Olsen, 1989)

Research examining teachers' use of educational technology for assessment is scarce. Many questions remain. The role technology takes in teachers' development and use of instructional assessment is relatively unexplored. Teachers are often excluded from the investigative process. If we are to successfully build integrated instructional and assessment systems that are valid and useful for teachers, then teachers must be partners in the process. They can articulate the everyday functions of assessment, and help to identify specific problem sets that integrate assessment with curriculum and instruction. Their experiences in the classroom make them useful guides in the journey to reform.

The entire Teachers Using Technology to Measure Mathematics Meaningfully Project (T^2M^3) had three underlying goals: (1) to determine expert and novice teachers' capabilities to develop comprehensive integrated assessment materials in mathematics; (2) to investigate the role that technology plays in helping teachers present integrated assessment situations and record and analyze student achievement; and (3) to investigate the changes in teachers' pedagogical reasoning, pedagogical content, and schemata as they develop and use integrated instructional assessment tasks. We hypothesized that investigation of these three research areas would increase our understanding of how capable teachers are of integrating assessment with instruction. We proposed to identify some of the ways that researchers, technology experts, and assessment experts can contribute to teachers' efforts to create integrated assessment. Data related to all of the research questions were collected by interviews with the participating teachers, observations of the teachers as they developed and used assessment materials, and comparisons of teachers' field notes and actual assessment materials. Details of the entire study are presently being compiled. Final analysis of the project will be available in forthcoming articles. However, throughout the project some themes have emerged. This paper deals specifically with one of these themes: the features of available technology that enhance teachers' abilities to deliver instructional assessment to students and continuously record, analyze, and evaluate information about students' knowledge, cognitive processes, and development in mathematics.

Methods

Participants.

Subjects for T^2M^3 were 15 teachers who met the following criteria: (1) taught elementary or middle school mathematics; (2) used some technology for instruction, (3) showed potential for extended involvement in the development and field testing of the T^2M^3 tasks; and (4) represented diverse groups and/or classroom situations that included students from under-represented groups. At the time they were selected, three taught primary level, six taught upper elementary level, three taught middle/junior high, two taught gifted children in grades one to six, and one taught math and computer for grades five to eight.

The selected teachers represented a broad range of expertise in teaching mathematics and in using technology. In addition, their schools provided very diverse populations. This teacher and student population allowed us to compare the application of tools and techniques across a wide domain of situations.

Treatment

The study consisted of four phases. During Phase 1, the 15 teachers were selected. Each teacher proposed a mathematics curriculum module they wished to expand to include assessment. Upon acceptance into the project each received a video camera to use in assessing themselves and their students. The camera was under the control of the teachers, available to them whenever they wished to use it.

Phase 2 entailed the development and presentation of the instructional treatment to help the teachers create an assessment module to the math module. The training program informed the teachers about various technological methods of presenting assessment information; available technologies for evaluating learning in mathematics; models of interactive assessment in mathematics; *National Council of Teachers of Mathematics* (NCTM) Curriculum, Professional, and Assessment Standards; and techniques for being a teacher-researcher. Workshops, hands-on activities, and collaborative work times provided the teachers opportunities to work with content area specialists, assessment experts, cognitive scientists, and technology specialists.

The teachers participating in the T^2M^3 Project received extended training in creating and using integrated mathematics assessment. Following the training, the teachers developed the instructional assessment component for their modules. This schedule of training and meetings ensured, as much as possible, that teachers received the support needed to successfully create effective assessment tasks.

In order to document teachers' capabilities to create meaningful classroom assessment materials, the progress of the participating teachers was carefully observed. These observations, conducted through videotapes and in-class visits, provided a thorough description of factors that enhanced or impeded the successes of teachers who have a range of pedagogical expertise. Providing detailed explanations of the progress of the various teachers furthered our understanding of teachers' capacity for developing original assessment procedures. Teachers' work during the project sessions provided exemplars of the models for assessment.

Results

The collaborative investigation of the project participants provided an opportunity to articulate technology's role in classroom assessment. The results are reported in two areas: tools and methodologies.

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Tools.

An important component of the T³M¹ was the actual technology that was available, or was made available to the teachers throughout the project. In order to depict the influence of these tools on the teachers' assessment techniques, we report our findings within three categories: school resources, new toys, and prototypes. These categorizations allowed us to represent all the tools that the teachers used during the project.

School Resources.

There was a range of technology available at each of the participant schools at the beginning of the project. Every school had televisions, video cassette recorders, calculators, and computers, and at least one videodisk player. Many of the 15 teachers had some of this technology in their classrooms.

Specifically, all had televisions available and could procure a VCR, videodisk, or video camera. At the beginning of the project, 5 of the 15 had one computer in their classrooms (either Apple IIEs or Macintosh LCs), 4 had two or more computers (a combination of Apples and either Macintosh LCs or MS-DOS 286 or 386s), and 6 had no computers in their classrooms. By the end of the project, all but 2 of the 15 had computers in their classroom, and most had acquired newer model Macintosh or DOS computers.

When the project began, only the four teachers with more than one classroom computer were using them for anything besides extracurricular activities or rewards for students. They used their computers for student projects and for classroom management and presentation. Few were using them for any aspect of assessment except record keeping. Throughout the project relevant use increased. The T³M¹ teachers increased their use of technology to administer assessment information and record student responses.

New Toys.

Once into the T³M¹ network, many of the teachers used their membership to learn about new sources of funding for equipment, to find out who had access to the resources, and to discover how to ask for their share. For many, it was also an opportunity to make better use of the technology at their schools. For example, few had used the videodisk player before the project began. Either they didn't know how to use it or didn't know what disks were available that would be appropriate to their curriculum. After being introduced to the Jasper Series many found ways to incorporate this technology into their instruction. Several found ways to acquire Jasper or similarly useful videodisk software.

In addition, each of the T³M¹ teachers was given a video camera so they could chronicle their assessment situations throughout the project. It also provided them with a "new toy." All but 1 of the 15 began to incorporate the camera into their daily class routines almost immediately. It provided them with a way for capturing classroom events, delivering information to students, parents, and colleagues, and documenting changes. By the end of the project, 14 were consistently using the camera as an assessment tool.

In several cases, involvement in T³M¹ gave the teachers the credibility they needed to be part of the group at their schools who got the new toys. Their participation in the project demonstrated their capability for using the technology and sharing their expertise with others. For one of the middle school teachers, it meant going from a classroom with no computer to having a high-end Macintosh with an overhead panel and a notebook computer in one year.

Prototypes.

With the fast pace of technological innovation, new tools are always emerging. However, teachers rarely gain access to these cutting-edge technologies early enough to influence their adoption and/or use at their schools. Throughout the T³M¹ the teachers were given access to potential assessment tools such as *Sunburst's* Learner Profile. This accomplished several things: it encouraged innovation and exploration, it enabled the T³M¹ teachers to be involved in professional development, and it provided informed feedback about the usefulness of the new tools to the educational community.

For example, the Learner Profile gave the teachers a way to quantify their observations. While many had previously used a paper-based system for recording observations (a folder with individual "sticky notes" for each student), the bar code and pen-based versions added several levels to their evaluations. With this tool, they were able to easily generate reports by student or by skill area. This facilitated their planning as well as their progress reporting. However, the consensus was that the bar code reader was difficult to use. The alternative, interfacing with the Newton, added several hundred dollars to the cost, which put it beyond the affordability of most of the schools. The teachers' recommendation was that, while the concept of an electronic tool for observation is useful, the technology itself still needs improvement.

Methodologies

The T³M¹ teachers found that incorporating technology into their assessment repertoire dramatically changed their assessment practices. The technology altered the ways they delivered assessment information, their methods of data collection, and their techniques for reporting information about their assessments.

Delivery.

Training during the T³M¹ enabled many of the teachers to discover ways to use different technologies to provide scenarios for assessment. They found diverse ways to present tasks, such as simulation exercises and audio taping tasks. Many learned how to use presentation software like *Hyperstudio* or *PowerPoint* to present mathematics tasks.

Data Collection.

Technology increased the teachers' capacity for accumulating indicators of student achievement. Sometimes the camera served as a "third eye," allowing teachers to monitor one group of students while working with another group. All of the teachers reported having used the camera to sometimes gauge the thinking processes of their students.

The T²M³ enabled 15 teachers to experience assessment with technology in a pragmatic, meaningful way. They were able to try out the technology, get assistance with the technology they already had, and share expertise with colleagues. The project team provided teachers with sustained opportunities to learn about the technology that enhanced their evaluation of students' achievements. The project also provided them with advocates and experts. This helped many of them make the case for technology with other teachers and their building administrators.

T²M³ empowered 15 teachers, providing them with easy access to technological tools, models of use, collaboration, and support. It helped diminish teachers' isolation and gave their students access to new forms of assessment. It offered support for the creation of new, dynamic educational assessment. It developed a strong network of active teachers willing to lead the way to new educational models. The group's continuation, through the dissemination of their work, will allow us to expand the network and provide teachers with leadership and continued support for alternative assessment.

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